stimulating and destructive agents; earth currents recorded at the Vesuvius Observatory in 1895, and the history of Vesuvius from 1875 to 1895; a mathematical investigation of the lines of nodes of vibrating membranes; the geology of the Southern Appennines (this elaborate paper occupies 128 pages); the alternate current transformer with a condenser in the secondary circuit; the physical constitution of the atmosphere, from the results of observations made during eight balloon ascents by James Glaisher, also a new formula for the calculation of altitude from barometric observations.—In the *Rendiconti del Reale Istituto Lombardo*, Prof. Luigi de Marchi gives a mathematical investigation of the effect of viscosity on the movements of glaciers.

NOW that acetylene can be readily prepared in the laboratory, many new uses will no doubt be found for it. The most recent proposal in this connection is that made by H. G. Söderbaum, in the current number of the *Berichte*. It appears that the gas can be employed for the quantitative precipitation of copper in ammoniacal solution, and for its separation from metals like zinc, which are not precipitated by ammonia. Acetylene possesses the great advantage over sulphuretted hydrogen, which is usually employed for this purpose, that it yields a precipitate which can be filtered and washed very rapidly, and which does not easily become oxidised and pass into solution. The washed precipitate is finally decomposed by dilute nitric acid, the solution filtered and evaporated to dryness, and the residue ignited and weighed as oxide.

THE additions to the Zoological Society's Gardens during the past week include an Orang-outang (*Simia satyrus*, ♂) from Borneo, presented by Captain Francis R. Pelly, R.N., H.M.S. *Porpoise*; a Bonnet Monkey (*Macacus sinicus*, ♂) from India, presented by Mrs. Douglas; a Rhesus Monkey (*Macacus rhesus*, ♂) from India, presented by Mr. P. A. Ledger; a Mongoose Lemur (*Lemur mongoz*) from Madagascar, presented by Mr. P. Baxter; a Grey Ichneumon (*Herpestes griseus*) from Ceylon, presented by Surgeon-Major C. Seymour; a Chimpanzee (*Anthropopithecus troglodytes*, ♀), a Black Gallinule (*Limnocorax niger*) from West Africa, presented by H.E. Colonel F. Cardew, C.M.G.; two Himalaya Goldfinches (*Carduelis caniceps*, ♂ ♀) from India, presented by Mr. Frank Finn; two Egyptian Geese (*Chenalopex ægyptiacus*, ♂ ♀) from Africa, presented by Mr. A. E. Speer; a Mauge's Dasyure (*Dasyurus viverrinus*) from Australia, presented by Mr. J. C. Chipper; a Peacock Pheasant (*Polyplectron chinquis*, ♂) from British Burmah, presented by Mr. Charlton Parr; a Burrhel Wild Sheep (*Ovis burrhel*, ♀) from the Himalayas, a Reed Buck (*Cervicapra arundinum*, ♂) from the Limpopo River, South-east Africa, a Sing-Sing Water Buck (*Cobus unctuosus*, ♂) from West Africa, a Somali Wild Ass (*Equus somilicus*, ♂), a Somali Ostrich (*Struthio molybdophanes*, ♂) from Somaliland, six Pintails (*Dafila acuta*, 3♂, 3♀), European; two Smith's Partridge Bronze-winged Pigeons (*Geophaps smithi*, ♂ ♀) from Australia, two White-headed Woodpeckers (*Leuconerpes candidus*) from Brazil, two Wreathed Hornbills (*Rhytidoceros undulatus*) from Borneo, a Silky Cow Bird (*Molothrus bonariensis*) from South America, purchased.

OUR ASTRONOMICAL COLUMN.

A REMARKABLE RELATION BETWEEN THE DISTANCES, MASSES, AND SURFACE GRAVITIES OF THE PLANETS.—In the *Bulletin Astronomique* for April, M. P. Berthot describes an ingenious empirical law which approximately connects the mean radii (R) of the orbits, the masses (m), and the values of g at the equators of the different planets. By employing a graphical method in which the abscissæ represent the values of gravity (p), and the ordinates those of $\frac{R}{m}$, all the planets, with the exception of Mercury, fall very approximately on an ellipse, $\frac{R}{m}$ being considered negative for all values of p greater or equal to 1, and the unit value of p being that at the surface of the earth.

If $\frac{1}{p}$, instead of p, be used as the abscissæ, the ellipse becomes then an equilateral hyperbola, and if the logarithm of $\frac{1}{p}$ be substituted, the same becomes a parabola. The following table gives the true and calculated values of p for one of the three curves, namely, the ellipse, computed by M. Berthot, those for the hyperbola and parabola showing somewhat greater errors per cent. in the case of Mercury. These latter are not referred to below.

	$\frac{R}{m}$	p (true).	p (calc.) ellipse.	Error for 100.
Mercury ...	6·350 ...	0·439 ...	0·502 ...	14·3
Venus	0·919 ...	0·802 ...	0·803 ...	0·1
Earth	1·000 ...	1·000 ...	1·000 ...	0·0
Mars	14·510 ...	0·376 ...	0·375 ...	0·3
Jupiter ...	0·017 ...	2·261 ...	2·284 ...	1·0
Saturn	0·103 ...	0·892 ...	0·877 ...	1·7
Uranus ...	1·414 ...	0·754 ...	0·764 ...	1·3
Neptune ...	1·824 ...	1·142 ...	1·120 ...	2·0

To make Mercury conform with the values calculated by the above-mentioned formulæ, it is suggested that either the old value of the mass determined by Le Verrier (0·0715) must be adhered to (contrary to more recent investigations), or, if the mass $\frac{1}{9,700,000}$ be retained, the diameter of the planet must be assumed to be one-quarter too large by the phenomenon of irradiation.

THE DOUBLE STAR 44 BOÖTIS.—This star, which was discovered on August 17, 1781, by Herschel, has recently (*Monthly Notices*, vol. lvii. No. 5) been pointed out by Mr. Burnham in consequence of the singular and remarkable arrest of the relative motion of the two stars. For a period of thirty years these stars gradually increased their distance from one another at a nearly uniform rate, the position angle at the same time slowly advancing. After this, for a period of equal length, the motion had apparently been arrested, and "down to the present time, they have remained absolutely at rest, so far as one can tell from full and careful sets of measures by the best double-star observers." This is a remarkable system, which evidently is unique among the known binaries, and, as Mr. Burnham points out, it is not easy to account for such a state of affairs. He remarks, however, that the usual dark-body hypothesis will readily suggest itself; and it is easy to imagine one of these stars with an invisible companion, both moving in a very eccentric orbit in a plane parallel to the line of sight, and to select a period and direction of motion that will not only explain the motion, but the absence of motion shown by the observations of the visible components, and "when this is presented with the usual refinements of computation, doubtless for the time being a plausible case could be made out." It will be interesting to watch this binary, and see, when the relative motion has been resumed and a decided change of position has taken place, whether an accurate, or even approximate, orbit can be obtained. The case is decidedly a unique one for double-star observers; and as there seems to be no question about the observations themselves, the steady change of position and subsequent arrest being based on "unimpeachable observations by the best observers," special interest will be attached to future measurements.

REPORT OF MR. TEBBUTT'S OBSERVATORY.—The energetic proprietor of this observatory presents a most satisfactory report for the year 1896, the amount of work accomplished being unusually large, owing to the very great number of clear nights experienced. The meridian work consisted chiefly in observing stars with the 3-inch transit instrument for checking the sidereal chronometer, which was used as timekeeper throughout the year. The observations of occultations of stars by the moon, made with the 8-inch equatorial, are stated to be the richest obtained in any one year since the foundation of the observatory. Other observations included 810 comparisons of minor planets with the filar micrometer, the phenomena of Jupiter's satellites, double and variable stars, and the regular meteorological work. The report states that all the astronomical and nearly all the meteorological observations were made by Mr. Tebbutt himself,

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but during a day's absence from home, about once in three weeks, the meteorological observations were made by his son. In some of the reductions the services of Mr. R. B. Walker were engaged. Quite recently a discussion of the early series of occultation observations made in the years 1864 to 1870 at this observatory, has been concluded by Dr. Hugo Clemens, of Göttingen, in his inaugural dissertation, with a most satisfactory result, which speaks well for the observations employed.

THE TWELFTH GERMAN GEOGRAPHICAL CONGRESS.

THE German "Geographentag," which takes place every second year, was held from April 21 to 23, in Jena. The meeting was attended by over five hundred persons from all parts of Germany, including Prof. Brackebusch, Colonel Frobenius, Prof. Karl Futterer of Karlsruhe, Prof. Gerland of Strassburg, Prof. Hahn of Königsberg, Dr. Hassenstein, Dr. K. Hassert, Herr von Hesse Wartegg, Prof. Kirchhoff of Halle, Captain Kollm (Secretary of the Berlin Geographical Society), Dr. Kretschmer, Count von Linden, Dr. Lindeman, Dr. Hans Mayer, Prof. Neumann of Freiburg, Prof. Neumayer of Hamburg, Dr. Schenck, Prof. Supan of Gotha, Prof. Sievers of Giessen, Prof. Wagner of Göttingen, Prof. Walther of Jena, Prof. Wahnschaffe of Berlin, and Count von Zeppelin. Twelve German Geographical Societies were officially represented, and two foreign Societies—the Royal Geographical Society and the Hungarian Geographical Society—sent delegates.

The town of Jena was decorated for the occasion, and the geographers were warmly received and handsomely entertained. Five meetings were held for the reading and discussion of papers, and each evening there was a social gathering, usually of an informal and genial character.

At the first meeting, after addresses of welcome had been given on behalf of the Grand Duke of Saxe-Weimar, the Municipality of Jena, and the University, the President, Prof. Neumayer, of the German Naval Observatory at Hamburg, delivered a short opening address, and then proceeded to present the Report of the German Committee on South Polar Exploration. He referred in the most generous manner to the approaching Belgian expedition, and to the projected British expedition, under the auspices of the Royal Geographical Society, but urged the importance of a national German undertaking, pointing out that there was scope for many expeditions, simultaneous or consecutive, in the vast unknown areas of the far south. The Committee appointed at the "Geographentag" at Bremen, in 1895, to arrange for a German Antarctic Expedition, had drawn up a comprehensive scheme, but the means with which to carry it out were still wanting. The aims of the expedition were defined as the study of meteorological conditions, terrestrial magnetism, geodesy, zoology, botany, geology, and ice-conditions, as well as geographical exploration. The expedition must, as an essential condition, winter for two years within the Antarctic Circle, while a second vessel carries on hydrographic work on the edge of the ice. The Committee had selected the longitude of Kerguelen Island as the most suitable point for attempting to force a way southward. The cooperation of the observatories in Cape Town, Melbourne, and in Mauritius would give special value to the meteorological and magnetic observations made in the selected part of the Antarctic area. Two vessels of about 400 tons would carry each four officers, four of a scientific staff, and a crew of twenty-two. The whole cost is estimated at under 50,000*l.*, and a strenuous appeal will be made to the German people to subscribe this sum, as soon as the important step of selecting a leader for the expedition has been taken.

The remainder of the first sitting was occupied by papers descriptive of explorations in Brazil by Dr. Hermann Meyer, and in Asia Minor by Dr. Zimmerer and Herr Roman Oberhummer.

The second sitting was devoted, as required by the rules of the Congress, to educational subjects, the most important paper being by Prof. Fischer, on the importance of geographical tours of considerable extent under the guidance of geographical instructors.

The third sitting was devoted to geo-physical questions. Papers on seismic observations were read by Prof. Gerland of Strassburg, and Prof. Supan of Gotha, both of whom dwelt on the urgent importance of establishing systematic seismological observations in all parts of the world. A lively discussion ensued, and Prof. Supan formulated a resolution, which was subsequently adopted, to the effect that the establishment of seismic observations in all countries should no longer be postponed, and that the "Geographentag" hoped that the German Government would take the necessary steps without delay to establish a system of observations in Germany similar to that which had been established and carried out with valuable results in Japan. Dr. Schmidt, of Gotha, read a paper on the geographical problems connected with the study of terrestrial magnetism, and Dr. Naumann, of Munich, spoke of the relation between the magnetic conditions and the geological and geo-tectonic character of a region, illustrating his remarks by reference to his own studies when engaged on the geological survey of Japan.

The fourth sitting was devoted to zoogeography, Dr. Semon, of Jena, discussing the fauna of Australia in the light of his recent researches. Prof. Hahn, of Königsberg, spoke of the distribution of transport animals, and the influence exerted by geographical conditions on the method of transporting goods on land. Dr. Schneider, of Dresden, read a paper on the fauna of the island of Borkum, to which he has devoted ten years of study, and has distinguished an immense number of species and varieties which had not previously been recognised.

At the fifth and concluding sitting, various resolutions arising out of the papers were proposed and voted upon. Breslau was selected as the place of meeting for the thirteenth "Geographentag" in 1899; and Prof. Walther, of Jena, read an important paper on the interpretation of Thuringian scenery by means of the geological structure of the district. He had previously, in the Geological Museum, demonstrated the geology of Thuringia by means of an ingeniously constructed model, which showed the somewhat complicated geological history of the neighbourhood in a strikingly graphic and simple manner.

By special invitation the geographers were shown over the great optical works of Messrs. Zeiss, and had an opportunity of seeing the whole process of the working of lenses and prisms, and the construction of the numerous forms of scientific instruments which are produced in the establishment. Excursions were also made to various places of interest in the neighbourhood, the geology and archæology of which were explained by competent guides.

A word must be said as to the social arrangements, which were of the happiest kind. At the dinner and "Festcommers," given by the town, a number of original geographical songs, composed by Prof. Leo Sachse, were sung, the allusions exciting much amusement amongst the visitors. After the dinner, Usambara coffee and Cameroons cigars were served, as an example of the increasing importance of the German colonies. Altogether the meeting presented an impressive picture of the solid work in scientific geography being carried on in Germany, and of the enthusiasm which professors and students alike bring to bear on the problems they attack.

THE INSTITUTION OF MECHANICAL ENGINEERS.

AN ordinary general meeting of the Institution of Mechanical Engineers was held on Wednesday and Friday evenings, April 28 and 30, the President (Mr. E. Windsor Richards) occupying the chair. Two papers were read—the first, on "Mechanical Propulsion on Canals," by Mr. L. S. Robinson; and the second, on "Experiments on Propeller Ventilating Fans and on the Electric Motor Driving them," by Mr. W. G. Walker.

Mr. Robinson's paper was of practical rather than of scientific interest. The most striking point brought out by the author was that it requires no more power to tow a long barge than a short one on a canal, an "enigma," to use an expression Mr. Henry Davy applied during the discussion, which neither the author nor the speakers at the meeting were able to explain. Mr. Robinson was of opinion that the chief point to be observed in canal navigation is the cross section of the canal. Shallow water is fatal to efficiency. This was borne out generally by the speakers during the discussion, Sir Leader Williams stating that it was useless to attempt improvements in mechanical details of tugs, &c., until the waterways were of a design that enable these improvements to be applied with advantage. A description was given of certain experiments made on a hydraulically propelled boat, fitted with a discharge orifice that passed through the stern-post of the vessel, and had a constricted passage, something of the nature of a *vena con-*

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